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N. W. ELECTRIC LIGHT & POWER ASSOCIATION

Delegates N. W. Electric Light & Power Association on Steamer Queen.

The third annual convention of the Northwest Electric Light and Power Association was held August 26-29, 1910, on board the steamer Queen, which encircled Puget Sound during the course of the meeting. Such a meeting place is unique in Pacific Coast annals and contributed greatly to the success of the convention, not only in improved attendance, but also in an excellent opportunity for the members to become well acquainted. About eighty members were in attendance, together with the wives constituting a party of about one hundred and thirty.

The members and guests assembled on board at Seattle, Friday evening, August 26th, and arrived at Tacoma early Saturday morning. Here they took sight-seeing cars placed at their disposal by the Tacoma Railway and Power Company, returning in

time to attend the first business session on Saturday afternoon.

This was opened with an address by President Arthur Gunn, president of the Wenatchee Valley Gas and Electric Company, who introduced W. J. Grambs as the author of the paper on "Rate Making," published elsewhere in this issue. Following the discussion on this paper, the convention went into executive session for consideration of the subject of legislation.

On Saturday night a dance was held at the Hotel Tacoma, the steamer thereafter proceeding to Everett.

No business session was held on Sunday, the day being devoted to rest and recreation. A number of neophytes were initiated into the "Order of Neptune," incidentally receiving an unexpected salt water bath. At a subsequent mock trial A. H. Buck, president of the Monroe Water and Light Company, was convicted of the heinous offense of selling electricity at 3 cents per kw. hour, his only defense being that his cost of production from saw-mill refuse justified the procedure. He was adjudged guilty of lunacy and sentenced to the Steilacoom Insane Asylum.

The party reached Vancouver about 8 o'clock Sunday evening, being there met by a delegation from the British Columbia Electric Railway Company, including Chas. Rummel, manager of the light and power department, W. T. Woodroofe, superintendent of the railway department, and H. E. Grant, illuminating engineer, who, together with D. R. Kennedy, superintendent of transportation and generation, and G. D. Robinson, of the engineering department, escorted the party on sight-seeing cars throughout the city. A fire alarm was turned in so that the visitors might see the electric-driven chemical engine.

Early Monday morning tally-hos took the party through the more beautiful parts of the city, the party disbanding at the Vancouver Hotel and proceeding thence to the boat. The reception tendered by the British Columbia Electric Railway Company was most hearty and was greatly appreciated by the visitors,

Monday afternoon A. C. McMicken read a paper on "Methods of Obtaining Business," as published in these columns of September 4, 1910. After discussion on this paper, D. L. Huntington's paper on "Depreciation" was read by Secretary Brockett in the absence of the author. This paper appears elsewhere in these columns. Arthur Gunn also read a paper on "Employers' Liability." The steamer meanwhile continued to Bellingham and thence to Seattle, where the meeting adjourned on Tuesday.

At the executive session on Monday evening officers were elected for the ensuing year.

Douglass Allmond, of Anacortes, is the new president of the Association, H. V. Gates, of Heppner, is vice-president from Oregon, F. Shields, of Moscow, vice-president from Idaho, Norwood W. Brockett, of Seattle, secretary and treasurer. The executive committee consists of M. D. Spencer, of Eugene, J. S. Thornton, of Aberdeen, and L. B. Faulkener, of Olympia, the latter being re-elected.

Exhibits were made by the Westinghouse Electric and Manufacturing Company, the Western Electric Company and Allis-Chalmers Company.

The entire meeting was voted a great success, resolutions of commendation attributing much to the energy of Secretary Brockett.

DEPRECIATION.[1]

BY D. L. HUNTINGTON.

Depreciation is now receiving the attention from all conservatively managed operating companies which it fully deserves. While opinion is still quite diverse as to the extent of depreciation and the methods of arriving conservatively at proper charges, nearly all companies are making some allowance in this direction. This has been brought about not only by the unavoidable realization, as the years go by, that such a charge must be provided for as a cost of operating the property, but closer attention has been drawn to the matter in the last few years through the growth of public service commissions which have undertaken the supervision and regulation of the rates charged; especially where rates have been regulated downward, a closer scutiny of items entering into the cost of service has brought the fact plainly to view that such charges must be included in the cost of operation.

Depreciation accounts in themselves must of necessity partake of the nature of estimates, and such estimates may vary widely one from another even on the same property through difference of opinion as to the nature of depreciation, the length of life of apparatus, and other considerations. Three methods of arriving at depreciation charges have come to the writer's attention.

First: Some properties arrive at the depreciation charge by taking the difference between an arbitrary percentage of their gross receipts and the amount charged for maintenance. This is an easy method, but has nothing special to recommend it excepting the fact of the facility with which the figures can be arrived at. It has no logical basis, and will undoubtedly not long continue.

Second: Other concerns have gone into the most elaborate determination of depreciation items, taking each piece of apparatus and each installation as it is made and opening a separate depreciation account for each such item, and extending the depreciation charge yearly for each such item, totalizing in order to arrive at the whole depreciation of the property. This method is probably more nearly accurate theoretically than any other method which has been used to any extent, but has the disadvantage of being extremely cumbersome, requiring a great deal of clerical and engineering labor and skill in its preparation.

Third: This method consists of taking the plant as a whole, grouping the various classes of apparatus, machinery, buildings, etc., into classes which are arbitrarily assumed to have about equal rates of depreciation. From these figures on the plant as a whole the charge for depreciation is arrived at. It is then determined what percentage of the total investment should thus be written off. This percentage may then be applied for several years to the property as it grows, when the whole process should be repeated with a view to determining whether any material change in the percentage thus arrived at has taken place, and a new percentage assumed for another period of years. This system does not entail anything approximating the labor and clerical force required by the second plan outlined above, and yet it has a

[1]Paper presented at convention N. W. Electric Light and Power Association, Seattle, Aug. 26, 1910.

logical basis which does not exist in the first plan mentioned, and it seems probable that it is along such lines that depreciation estimates will be arrived at in the future.

In determining the percentage of depreciation for application to the plant as a whole many factors must be considered. In the first place the actual life of machinery, apparatus, buildings, etc., should be determined as accurately as experience will permit. Second, the rate at which such properties become obsolete, regardless of their actual serviceable life, should be determined. For instance, a machine may be carried through a long period of time, perhaps twenty or twenty-five years, and by judicious repairs and maintenance, be kept in almost as good condition, as far as service is concerned, as it was at the time of its installation. Long before the period of its useful life as a serviceable machine has expired it may become obsolete to such an extent, on account of changes of methods, new discoveries, size of units, efficiency of apparatus, etc., that it becomes a useless burden upon the system, and must be discarded as an asset for that reason. This feature of depreciation is, in all probability, the most difficult one to determine upon, and one upon which there will be greater difference of opinion than on almost any other portion of the depreciation item, for the reason that it requires one's judgment as to what the future development of the business may be five, ten or even twenty years later.

Another consideration of importance upon which there would be difference of opinion, is as to what provision should be made with regard to the expiration of franchise rights. Shall it be assumed that we can safely expect a renewal of our franchises or public rights at their expiration, upon terms sufficiently reasonable to enable us to go on with our business, or must we assume that at the expiration of our franchise we must have placed ourselves in a position where we have retired the investment which has been made for the purpose of doing business under such franchises? I think that the managers of most properties will arrive at the conclusion that this franchise expiration feature will have to be largely eliminated from the question, and that it will have to be assumed that such properties will be continued in operation under new franchises or agreements with municipalities, or public service commissions, which will permit their proper and profitable operation.

In determining the total depreciation of the property of a company consideration must be given to the value of real estate, water power rights, freight and passenger terminal lands, for the reason that they may not only not depreciate, but they may, and probably will, in most communities, show an actual, and perhaps a very large, appreciation in value, and these should be taken as an offset as against the depreciation charges otherwise arrived at.

In general a carefully managed property will charge off to depreciation a sum which is conservatively sufficient to meet the purpose for which it is made, as any other course will, in the long run, where prices are close or competition is keen, lead to financial disaster, and it is much better to make, apparently, a showing somewhat less satisfactory on our books, and in our statements to our stockholders, than might possibly be justified by a less conservative statement, than to run any material risk that at some future time we will have to show to our stockholders a condition of impairment of capital.

The purpose of this brief paper is merely to outline in general a few ideas on the subject, with a view more to stimulating discussion and bringing out the ideas of other persons, than to lay down any rules or dictum from the writer's standpoint. It is sincerely hoped that the subject will receive the earnest consideration which it deserves, and that a very full discussion of the matter will take place, which cannot help leading to a better understanding of one of our most serious financial problems.

NOTES ON RATE MAKING.[1]

BY W. J. GRAMBS.

Electrical energy for light and power should be considered a service rather than a commodity. It cannot be stored up like gas, and the generating plant may be called upon any time to furnish the maximum demand of a consumer's installation, although this may happen only occasionally. The central station must therefore prepare to meet the consumer's demand by installing an equal amount of generating apparatus.

The proper method of arriving at rates for electric light and power current has been the subject of much discussion, and various forms of rates and schedules have resulted. Local causes and influences greatly vary the results obtained by different companies, and the actual rates vary in different localities, but the underlying principles on which the rates are based should be the same.

Flat rates are objectionable because short hour consumers are compelled to pay as much as long hour consumers for the same load, and in addition to this, flat rates lead to wastefulness.

A straight meter rate is satisfactory only where all consumers use electricity in the same way and under similar conditions. Such a rate, however, is as unfair and unwise as it would be to require a uniform rate for all classes of freight.

The plan of getting what you can in competition leads to various rates for exactly the same class of service, and eventually to financial ruin.

The quantity discount plan, where a specific rate is given for each class of service, and then step by step discounts made for quantity used, is a step in the right direction, though only a partial solution of the problem.

The "two-rate" or primary and secondary rate scheme, and the readiness-to-serve scheme, based on maximum demand, can combine practically all of the features which go to make up an equitable rate.

One of the things which restricted central station progress for years was the failure to recognize the great difference in the cost of serving different classes of consumers. There is no discrimination when a rate automatically gives a lower rate to a consumer because of greater hours of use per day of electricity, when such rates are open to everybody and depend entirely on the class of service demanded.

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[1]Paper presented at Seattle Convention N. W. Electric Light and Power Association, Aug. 26-29, 1910.

A theoretically correct rate, i. e., one which will divide the cost and profit equitably between all consumers, would be extremely complicated, and would cause dissatisfaction not only on account of it not being generally understood, but on account of certain other features, among which might be mentioned the following:

(a) Very short hour users would pay an extremely high rate per kilowatt hour.

(b) Location of customers as regards point of generation would have to be taken cognizance of on account of difference in line losses.

(c) Large consumers would have to pay a rate which would increase isolated plant competition.

A high rate for short hour users, while justifiable, has been found to be impracticable, and is conducive to rate regulation by civic commissions.

Variation in rate on account of locality has likewise been found not to be good policy.

Large consumers must be given a price only slightly in excess of what they can furnish the same service for themselves, which may be somewhat less than the ideal equitable rate.

Now, since it is not practical to charge the short hour user and the large consumer at the theoretically correct rate, the additional profit must be made on the intermediate consumers.

In making up or revising rates it is always best to determine the theoretically equitable rate for each class of consumer and to vary this as occasion demands.

In making up this theoretical rate for each class of service there are four general divisions of expense to be taken into account, and which go to make up the total cost to the consumer, to wit:

(1) A consumer's charge.

(2) A capacity charge or (a) fixed charges based on the generating plant and (b) fixed charges based on the distributing system, which included converting and regulating apparatus, lines, transformers, etc.

(3) An output charge.

(4) Profit.

The consumer's charge should cover cost of reading meters, collecting, billing, and all costs which vary with the number of customers, and is usually arbitrarily fixed at $1.00 per month.

The capacity charge should cover bond interest, general salaries, general expense, and all other items due to the capacity of the station and distributing system.

The output charge should cover operating supplies, fuel, oil, waste, labor, and all expenses depending on the output of the station, and profit.

The fixed charges on the operating plant should be divided among consumers in direct proportion to the consumer's effect on the peak load, whether they be light or power customers. To divide this, what is generally known as "diversity factors" must be obtained between the consumer's service and the generating station. If this diversity factor is known, or can be found, the division of fixed charge on plant can readily be made.

The fixed charges on the distributing system vary in general with each class of customer, and for residence lighting forms the largest part of the cost. For large power customers it becomes only a small portion of the cost. The fixed charges on the distributing system cannot be divided in proportion to the amount each consumer's current is to the total current in the lines at peak, or at any other time, but must be found for each class of service separately.

The short hour consumer will automatically pay a higher rate and the long hour consumer a lower rate, and the longer the use each day the lower the rate and there will be no overlapping points as in many of the discount and step rates. Such a rate will be approximately correct and be equitable to all concerned. The rate will discriminate between profitable and unprofitable consumers and will make all bills more uniform throughout the year by lowering the winter bill and increasing the summer bills.

After the theoretical rates have been determined by an analysis of costs in conformance with the above, then the rates should be made as simple as possible so that the customer can readily understand their application to his load.

Residence Lighting Rates.

While it is true that a consumer's load factor should determine his rate, the difficulty and expense of getting such data in the case of residential lighting would suggest some simple schedule readily understood by the consumer and which will insure a fair return to the central station. The diversity of residence lighting is such that the maximum demand of various consumers does not correspond. The residence peak will last from three to five hours and does not, as a rule, come on until after the commercial power load is off. There is no doubt that the cost of carrying the small residence consumer is abnormally high, due to meter and transformer costs and changes, accounting and collection costs, and it is therefore proper to make a higher rate for residence service. The residence consumer, in spite of his relatively large occasional demand the general expense he entails, has one compensating virtue in that his peak does not, as a rule, add itself to the general peak but follows it.

All maximum demand schemes tend to discourage domestic use of electricity. In order to determine the maximum demand in a residence it has been the practice to assume the maximum demand to be from 30 to 50 per cent of the consumer's connected load, maximum demand meters being too expensive for this class of lighting. This puts a penalty on numerous convenient lamps in closets and other out of the way places which are only occasionally used. An assessed maximum demand is undesirable because of the frequent change of lamps in a residence, and unless a frequent check of the service is made there will be a great inequality in the rate which a consumer will get from time to time.

The consumer having a good load factor and the one having a large demand should both have a concession in rate—the first on account of reductions in generating plant fixed charges per kilowatt hour—and the second on account of reduction in general expenses and distribution of fixed charges per kilowatt hour.

Power Rates.

Power rates should be based on the same general principles that light rates are based upon in order to

be equitable. The fixed charge must be distributed in proper proportion among the various consumers so that each customer pays fixed charges on the capacity of the plant required to serve him, after which the rate should distribute the operating expense and profit among the customers. Power should be charged for on the average peaks of the consumers upon the generating station rather than by the individual peaks of the different consumers, which will as a rule occur at other times than during the peak of the station. As a matter of fact, the maximum demand of power customers will usually occur during the light period of the day, and due to the diversity of the load, these peaks coming at different hours of the day make it possible for the station to handle the load more economically. There is also a diversity of load between power and residence lighting, because as the power load goes off at the end of the day the residence load comes on. Power for small consumers can usually be furnished by electric light companies without substantially increasing the investment. The price must be low enough to make the service attractive, and it cannot be sold to the consumer much in excess of what it would cost him to make it. The rate must be simple, but it should be fixed and variable expense.

The Commonwealth Edison Company, of Chicago, determined the percentage of maximum demand to the connected of about four thousand motor customers to be as follows:

Installations under 10 h.p. 1 motor used.....	85%
Installations under 10 h.p. more than I motor used	75%
Installations of from 10 to 50 h.p. irrespective of number of motors used	65%
Over 50 h.p. irrespective of number of motors used	55%

Owing to the diverse character of load and the different hours of maximum demand, the connected load may be two or three times the station capacity.

Wholesale Power Rates.

Wholesale power rates should carry a primary charge or guarantee based on the maximum demand and load factor, plus a secondary kilowatt hour rate based on the variable expense and profit. It is difficult, however, to establish a system of rates based on one primary and one secondary charge because of the fact that it costs proportionately more to serve a small consumer than to serve a large consumer, and also because the cost of making current during long hours per day is less for the same demand than it is where the service is for short hours per day.

The effect of competition by other public service corporations will have an effect not only on the form of rates or the general rate plan, but on the actual rates themselves. As an example, the Municipal Plant of Seattle, which also does a large commercial business, will quote a rate to a customer who uses his power for twenty hours per day or longer so low that The Seattle Electric Company could not possibly take the business and make a profit. On the other hand, The Seattle Electric Company has been able to take business away from the municipal plant and make a good profit when the customer only uses his power from eight to ten hours per day.

With competition of this sort any lack of return from long hour business must be made up on the shorter hour business, and the schedule must be made up accordingly.

Competition should be met by improvement in service, and by a schedule of rates designed to fit your own and your competitor's costs.

Mr. S. E. Doane, chief engineer of the National Electric Lamp Association, read a paper before the N. E. L. A. at St. Louis on the effect of high efficiency lamps on the cost of light to the central station. The paper was listened to with a great deal of interest, and I have taken the liberty of presenting Mr. Doane's paper herewith in an abbreviated form in the belief that you will all be interested in what he said, as follows:

"Dr. John Hopkinson, F. R. S., in 1892 established a broad principle that was recognized and accepted by the electric light industry as correct, which divided costs of current into fixed and operating classifications."

"Henry L. Doherty in 1900, in a paper read before the National Electric Light Association, worked up the same idea and further divided the fixed cost into two sub-divisions—and Mr. Doane in his paper worked along the lines indicated by Mr. Doherty. He consulted central station men of much experience from all parts of the country, and a number of men from his staff were employed for a period of two years collecting and working up the data upon which he bases his deductions."

In discussing the effect of the high efficiency lamp on central station costs his analysis and arguments were based on the following premises:

1st. The discussion was limited to the lighting load.

2nd. In order to obtain a fair average the analysis cover a period of at least one year.

3rd. The station capacity of the various plants is considered not greatly in excess of the maximum demand.

4th. The items of outgo, such as dividends, interest, depreciation, obsolescence, and all losses, are as much items of cost as the items of coal, labor, etc.

As a basis for his discussion he presented Table I —the result of a careful cost analysis of a number of central stations. The percentage distribution of the total cost under the items "General Expense," "Distributing Expense," "Generating Expense," etc., is shown separately for each of the four cases represented in the column headed "% of Total Station Expense."

Each of these items was further analyzed and distributed by percentage under one or more of the headings as shown in the last three columns of Table I. The proportion of each item charged to "Output" represents the relative proportion of the cost which depends upon cost per k.w.h. The proportion of each item charged to "Demand" represents the relative proportion of the cost that depends on the capacity of the plant, which in turn depends upon the "Demand." The portion charged to "Consumers" represents the relative proportion of the cost which depends upon the number of consumers connected and served.

TABLE 1.

Central Station Cost Analysis.

Item		% of Total Station Expense	% Item Output	Proportional to Demand	Proportional to Consumers
General Expense	a	12.7	....	75.4	24.6
	b	14.5	....	71.0	29.0
	c	10.2	....	82.8	17.2
	d	10.9	....	80.0	20.0
	Weighted average	12.0	....	76.9	23.1
Distributing Expense	a	15.2	50.2	26.4	23.4
	b	9.7	44.7	21.4	33.9
	c	17.8	50.6	24.7	24.7
	d	12.8	31.8	56.9	11.3
	Weighted average	14.4	47.0	28.9	24.1
Generating Expense	a	13.4	80.7	19.3	....
	b	17.7	74.6	25.4	....
	c	32.1	70.3	29.7	....
	d	32.3	67.9	32.1	....
	Weighted average	23.9	72.0	28.0	....
Taxes and Insurance	a	8.1	....	80.0	20.0
	b	10.9	....	86.2	13.8
	c	6.8	....	85.9	14.1
	d	4.4	....	80.0	20.0
	Weighted average	7.8	....	84.0	16.0
Depreciation	a	11.6	....	80.0	20.0
	b	11.5	....	79.5	20.5
	c	9.0	....	85.9	14.1
	d	6.0	....	80.0	20.0
	Weighted average	9.8	....	81.8	18.2
Interest and Dividends	a	39.0	13.1	68.1	18.8
	b	35.7	27.2	55.1	17.7
	c	24.1	26.4	61.4	12.2
	d	33.6	8.9	73.7	17.4
	Weighted average	32.1	19.7	63.7	16.6
Total.....	a	100.0	23.5	58.5	18.0
	b	100.0	27.2	55.1	17.7
	c	100.0	37.9	50.8	11.3
	d	100.0	28.9	59.5	11.5
	Weighted average	100.0	30.3	55.1	14.6

"a" Represents a large Central Station giving free renewals.
"b" Represents a large Central Station giving free renewals.
"c" Represents the average of about 70 Stations in the East.
"d" Represents the average of about 40 Stations in the West.

In the table each item of cost has been listed under fixed or operating cost, or has been divided and party listed under fixed or operating costs. Fixed costs have been divided into "Demand Costs" and Consumers' Cost."

The "Demand Cost" covers the cost involved in supplying the maximum demand, and a proper allowance was made for diversity factor in arriving at this cost.

The "Customers' Cost" for the average customer is a cost which an individual customer causes, whether or not he actually consumes any current.

The following rule was applied to determine the cost divisions:

If the analysis of any cost showed that an increase of 100 per cent in the number of customers, without the total output or total demand necessarily being increased, would presumably double the expense, such as reading of meters, it was taken as an item which varied directly with the number of customers and was classed as 100 per cent "Consumers' Expense."

If an item of cost would be doubled with an increase of 100 per cent in capacity of the plant, even though the number of customers remained the same, such an item was classed as a "Demand Expense." In a similar way items would be classed under "Output."

Mr. Doane believes that the percentages given in his table are conservative, and that they indicate, at least, the nominal cost at which a new customer can be added to the system on the present basis.

Every customer, no matter how small, must have a pair of wires and necessary poles, fixtures, etc., to bring wire to his premises—he must have a meter and demands some attention in the way of meter reading inspection, billing, etc. Consequently, he costs the central station a definite minimum amount per year although he uses no current whatever.

Mr. Doane then proceeds to discuss the effect of high efficiency lamps on the cost of serving the central station average customer, after which he considers the effect of the high efficiency lamp in serving larger and smaller customers with larger and smaller load factors.

Taking the figures in Table 1 Mr. Doane plotted some diagrams which show the effect of the adoption of high efficiency lamps by a customer of 1.6 kilowatts maximum demand and 11 per cent load factor, which is about the average load factor for residence lighting in Seattle. The fixed customers' cost is indicated by the letter "C"—the total demand cost for 1.6 kw. maximum by the letter "D," and the total cost of the kw. h. actually consumed by the letter "O." The value of these representations for carbon lamps in Figure 1 is as follows: "C," 14.6 per cent; "D," 55.1 per cent; "O," 30.3 per cent of the total as shown for the average in Table I.

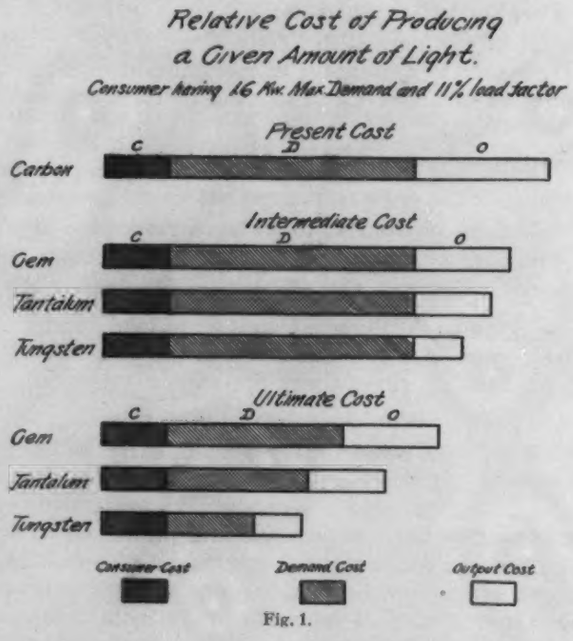

Fig. 1.

The first single rectangle in Figure I represents the cost of an average consumer with a maximum demand of 1.6 kw. and a load factor of 11 per cent burning carbon lamps. When this average customer changes to high efficiency lamps and obtains the same amount of light as before the result is shown in the middle group of diagrams. The longest parallelogram shows the effect of the cost when the gem lamp is adopted, the next the tantalum lamp and the third when the tungsten lamp is adopted. If no new customers are added the central station cannot reduce the customers or demand costs charged against the customer, and the sole reduction in cost is the reduction in kw. hrs. required to produce the same amount of light.

In this illustration Mr. Doane shows that the reduction of cost due to the adoption of the Gem lamp is 8.7 per cent, for the tantalum 13 per cent, and for

the tungsten 19.5 per cent, and, assuming that the tungsten lamp for a given amount of light only uses 1-3 the amount of current that the carbon lamp uses, the cost of light is only reduced by 2-3 of that portion of the cost which varies with the kw. hrs. The total cost reduction is, therefore, only about 20 per cent instead of 60 per cent.

Referring again to Figure 1, the lowest group of short rectangles shows what happens when the station has added enough new customers to utilize its output, all customers using high efficiency lamps. Under these conditions the cost of producing light for the average consumer with the tungsten lamp is reduced 55 per cent.

Figures 2 and 3 assume a customer of small size having a maximum demand of 0.5 kw. with load factor of 7 per cent and 20 per cent respectively. In the case of the consumer with 7 per cent load factor the cost of kw. hrs. is only 16 per cent of the total cost with carbon lamps, and about 6 per cent with the tungsten lamp.

The astonishing fact was developed that even such short hour burners with small maximum demands receive the full benefit of the tungsten lamp by adding enough customers to take up the entire capacity of the central station the cost of current consumed is only about 10 per cent of the total cost of carrying such a consumer. Even in the case of a comparatively long hour consumer, as shown in Figure 3, having a small maximum demand, the kw. h. consumed cost the central station but a very small part of the total cost for the customer. Most of the cost for a small consumer is due to supplying the service to the customer. The diagrams show that the high efficiency lamp reduces the cost of producing a given amount of light for the average small customer, but this reduction of

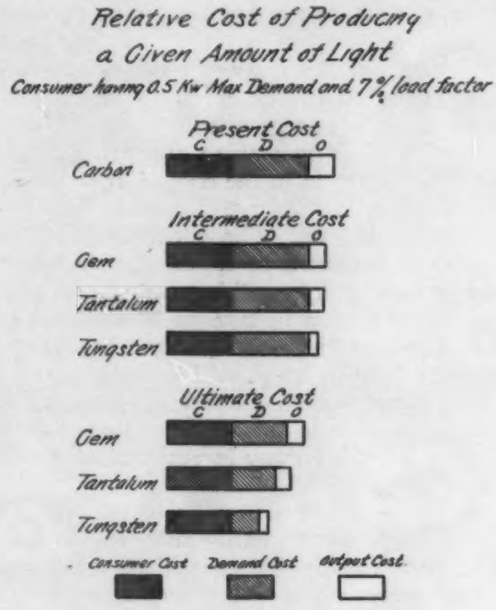

Fig 2.

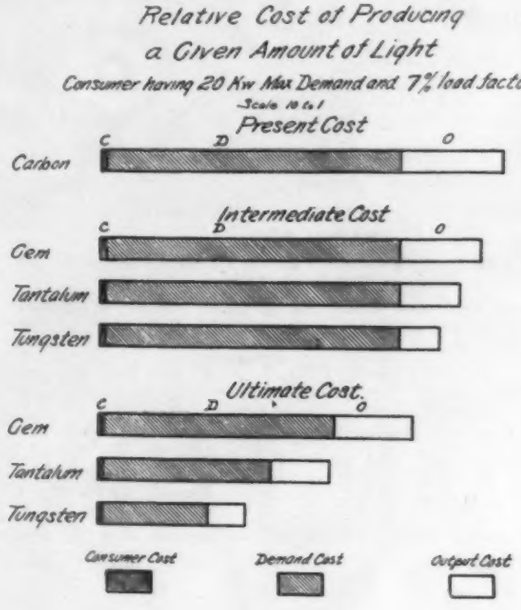

Fig. 4.

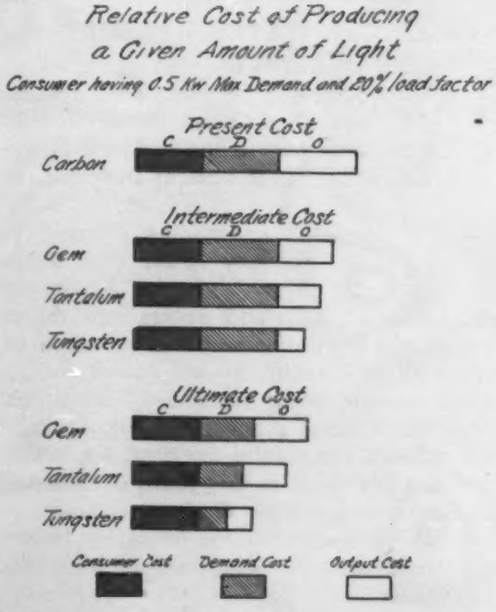

Fig. 3.

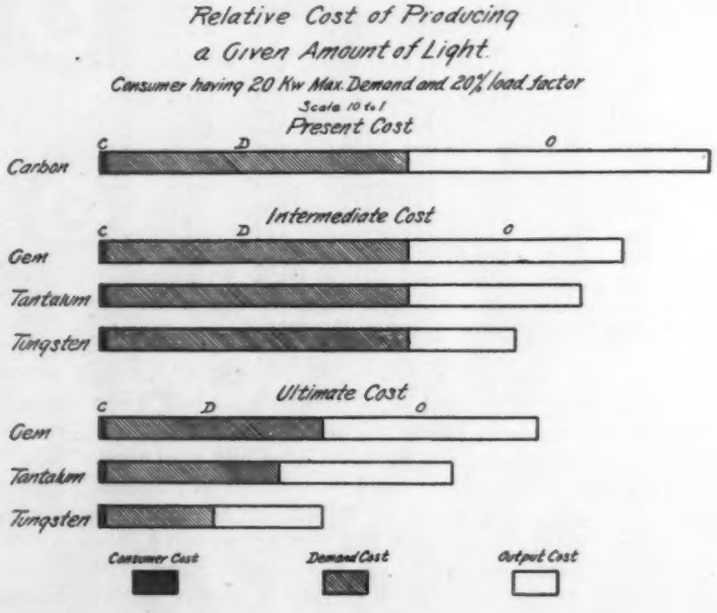

Fig. 5.

cost is in no sense comparable with the reduction in current required for a given amount of light.

Figures 4 and 5 show a large consumer, and it will be observed that the consumer's cost is a very small part of the whole. The reduction in cost due to the use of tungsten lamps by a short hour consumer is only about 15 per cent when additional new customers have not been taken on by the central station.

The following table gives a summary of the foregoing diagrams:

Table 2.

Relative Cost of Serving Customers.

Consumer	Present Cost Carbon	Intermediate Cost Tanta- Gem	Intermediate Cost Tungs- lum	Intermediate Cost Tungs- ten	Ultimate Cost Tanta- Gem	Ultimate Cost Tanta- lum	Ultimate Cost Tungs- ten
Average	100.	91.3	87.0	80.5	75.6	63.8	45.1
Small—Short hr.	100.	95.5	93.2	89.8	82.5	73.8	60.6
Small—Long hr.	100.	88.1	85.0	77.4	80.0	70.0	54.9
Large—Short hr.	100.	92.7	89.1	83.6	71.8	57.8	36.7
Large—Long hr.	100.	85.9	78.8	68.2	71.7	57.5	36.3

Consumer	Maximum Demand K.W.	Load Factor
Average	1.6	11%
Small—Short hr.	0.5	7%
Small—Long hr.	0.5	20%
Large—Small hr.	20.0	7%
Large—Long hr.	20.0	20%

Each consumer is assumed to use the same total amount of light before and after changing from carbon to high efficiency lamps.

TABLE 3.

Effect on Station Cost and Output Produced by Adoption of the Highest Efficiency Lamps.

(Assuming that each consumer produces the same amount of light with highest efficiency lamps as with the lamps of low efficiency.)

Number of Consumers in % of the number supplied at present with low efficiency lamps	COST TO STATION Consumer	Demand	Output	Total	Kw-hrs. Consumed and maximum demand in % of that with low efficiency lamps	RELATIVE COST *Per Kw-hr.	Per Consumer
100% using low efficiency lamps	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Changed to the following per cent using highest efficiency lamps	14.6	55.1	30.3	100.0	100.0	100.0	100.0
100	14.6	55.1	10.8	80.5	35.7	225.0	80.5
110	16.1	55.1	11.9	83.1	39.3	212.0	75.5
120	17.5	55.1	13.0	85.6	42.9	200.0	71.4
130	19.0	55.1	14.1	88.2	46.4	190.0	67.8
140	20.4	55.1	15.1	90.6	50.0	181.0	64.7
150	21.9	55.1	16.2	93.2	53.6	174.0	62.1
160	23.4	55.1	17.3	95.8	57.2	168.0	59.8
170	24.8	55.1	18.4	98.3	60.7	162.0	57.8
180	26.3	55.1	19.5	100.9	64.3	157.0	56.1
190	27.7	55.1	20.6	103.4	67.9	152.0	54.4
200	29.2	55.1	21.6	105.9	71.4	148.0	52.9
210	30.7	55.1	22.7	108.5	75.0	145.0	51.7
220	32.1	55.1	23.8	111.0	78.6	141.0	50.4
230	33.6	55.1	24.9	113.6	82.2	138.0	49.6
240	35.0	55.1	26.0	116.1	85.7	135.0	48.4
250	36.5	55.1	27.1	118.7	89.3	133.0	47.5
260	38.0	55.1	28.1	121.2	92.9	130.0	46.6
270	39.4	55.1	29.2	123.7	96.5	128.0	45.8
280	40.9	55.1	30.3	126.3	100.0	126.0	45.1

*Please do not confuse this with the output cost per kw-hr. which remains practically constant throughout.

Table 3 shows in a general way what might be expected when all central station customers will have changed to tungsten lamps. This of course will not actually ever happen, but between now and that time each station will have increased its number of customers, and the table is made to include all percentages beginning with no increase and ending with 180 increase in customers, at which time the station will be entirely loaded again. The table is further based on the theory that the customer will not increase the amount of light he uses at peak. The table shows that the consumer's costs, which are the costs per customer for distributing the current generated, are the costs which concern the central station to a constantly increasing extent. The investment in meters and length of line necessary to reach a customer, etc., will be of greater importance to the station man than the efficiency of the generating apparatus.

The table further shows that when a station has added 80 per cent more customers than its total costs will again have reached the present cost with carbon lamps, and the cost per kw. h. will be about 60 per cent greater than at present. Mr. Doane in his paper brings out the following points:

The logical effect of the high efficiency lamp is to increase the number of small consumers. This means an increase in the proportion of the central station expense for labor in connection with the distribution system and accounting, etc., or consumer's cost.

The addition of many new customers will improve the load factor. The high efficiency lamps will enable the central station to greatly increase the number of customers without increasing the generating investment. The reduction in the cost of light can never be so great as the customer expects—he always associates the two-thirds reduction of current consumed with a two-thirds reduction in cost. The decrease in the cost of furnishing light will be measured by the ability of the central station to take on additional consumers who will assist in bearing the fixed expenses.

High efficiency lamps will be made more efficient and the central station must adopt policies that will not only take care of the present lamp situation, but which will provide for any increase in their efficiencies in the future.

Ductile tungsten is now being manufactured and tungsten lamps will be hardy and capable of satisfactory employment in residences and other places, so that ultimately nearly every customer of a central station will use the lamp.

ANCIENT MEXICAN WATER MEASURES.

The old Mexican standards for measuring water have long since been displaced by the metric system for engineering work, but the old nomenclature is still in use among the common people and is found in the old records and writings. These ancient hydrometric measures are as follows: 1 buey (ox), 48 surcos; 1 surco (furrow), 3 naranjas; 1 naranja (orange), 8 reales or limones; 1 real (bit) or limon (lemon), 2 dedos; 1 dedo (finger), 9 pajas (straws). According to the old ordinances of lands and waters established in Spanish times, the buey of water was as much as would flow through an aperture 1 vara (0.838 meter) square, no head pressure being mentioned. By a law of the Mexican Republic of August 2, 1863, 1 surco was equal to 6½ liters per second for rural measures, and the paja was made equal to 0.45 liters per minute for town measurements. This distinction was intended to make the surco a unit for irrigation, while the paja was made unit for distributing water to houses, etc., in towns.

CALIFORNIA FUEL OIL.

BY R. F. CHEVALIER.

Draft.

The term draft as employed in boiler practice refers to the difference in density or weight of the external air and the heated gases in the passes of a boiler or stack. Atmospheric pressure is due to the weight of the air. The pressure on any given area is measured by the weight of a column of air having that area as a base and the height equal to that of the atmosphere. This height has not been accurately determined. The density of the air decreases as the distance from the earth increases. For all practical purposes in calculations it may be assumed that this density is uniform throughout. Under ordinary conditions at sea level, the atmospheric pressure is 14.69 pounds per square inch. At this pressure, a cubic foot of dry air at 50 degrees F. has a density or weight of 0.077884 pounds.

Difference in density is due to heat, which expands the air and so reduces the density per unit volume. Were a column of air enclosed in a vertical cylinder, such as a chimney or stack, and heated, the heated lighter air would be forced up by the heavier cold air entering to take its place, which, when in turn heated, would follow the same course. A continuous flow would thus be set up, the velocity and volume of which would depend upon the temperature to which the air was heated, and the height of the cylinder, which would determine the difference in pressure at the base of the cylinder due to the height of the column of air.

The difference in density results from the application of heat, but the action of gravity is directly responsible for the movement of the air.

The relative difference in weight between the air in the cylinder and that of a similar column in the atmosphere may be expressed in any convenient term, as, pounds per square foot, ounces per square inch, or by the height of a column of water or mercury necessary to balance their pressure.

Although usually expressed as "draft pressure," the pressure is below that of the atmosphere, and in reality is a measure of the difference in pressure. This difference in pressure or draft is usually measured in inches of water. One cubic foot of water at 50° F. weighs 62.409 pounds; therefore, a column of water at this temperature 1,728 inches high and one square inch cross-sectional area would exert a pressure of 62.409 pounds per square inch and a pressure of one pound per square inch would be exerted by a column

$$\frac{1728}{62.409} = 27.7 \text{ inches high.}$$

From this, it is readily deduced that an ounce pressure per square inch is produced by a water column 1.73 inches high and that one inch head of water is equivalent to a pressure of 0.578 ounces per square inch. Table No. 8 shows the relation for different heights of water column. Table No. 9 indicates the height of water column corresponding to any given pressure in ounces per square inch.

TABLE NO. 8.

Pressures in Ounces per Square Inch Corresponding to Various Heads of Water in Inches.

Head in Inches.	Decimal Parts of an Inch.									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0.....		0.06	0.12	0.17	0.23	0.29	0.35	0.40	0.46	0.52
1.....	0.58	0.63	0.69	0.75	0.81	0.87	0.93	0.98	1.04	1.09
2.....	1.16	1.21	1.27	1.33	1.39	1.44	1.50	1.56	1.62	1.67
3.....	1.73	1.79	1.85	1.91	1.96	2.02	2.08	2.14	2.19	2.25
4.....	2.31	2.37	2.42	2.48	2.54	2.60	2.66	2.72	2.77	2.83
5.....	2.89	2.94	3.00	3.06	3.12	3.18	3.24	3.29	3.35	3.41
6.....	3.47	3.52	3.58	3.64	3.70	3.75	3.81	3.87	3.92	3.98
7.....	4.04	4.10	4.16	4.22	4.28	4.33	4.39	4.45	4.50	4.56
8.....	4.62	4.67	4.73	4.79	4.85	4.91	4.97	5.03	5.08	5.14
9.....	5.20	5.26	5.31	5.37	5.42	5.48	5.54	5.60	5.66	5.72

TABLE NO. 9.

Height of Water Column in Inches Corresponding to Various Pressures in Ounces per Square Inch.

Pressure in ounces per sq. inch.	Decimal Parts of an Ounce.									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0.....		0.17	0.35	0.52	0.69	0.87	1.04	1.21	1.38	1.56
1.....	1.73	1.90	2.08	2.25	2.42	2.60	2.77	2.94	3.11	3.29
2.....	3.46	3.63	3.81	3.98	4.15	4.33	4.50	4.67	4.84	5.01
3.....	5.19	5.36	5.54	5.71	5.88	6.06	6.23	6.40	6.57	6.75
4.....	6.92	7.09	7.27	7.44	7.61	7.79	7.96	8.13	8.30	8.48
5.....	8.65	8.82	9.00	9.17	9.34	9.52	9.69	9.86	10.03	10.21
6.....	10.38	10.55	10.73	10.90	11.07	11.26	11.43	11.60	11.77	11.96
7.....	12.11	12.28	12.46	12.63	12.80	12.97	13.15	13.32	13.49	13.67
8.....	13.84	14.01	14.19	14.36	14.53	14.71	14.88	15.05	15.22	15.40
9.....	15.57	15.74	15.92	16.09	16.26	16.45	16.62	16.79	16.96	17.14

The simplest form of a draft gauge is the U-shaped tube as shown in Fig. 3. To one arm is connected a tube which leads to a point where the draft

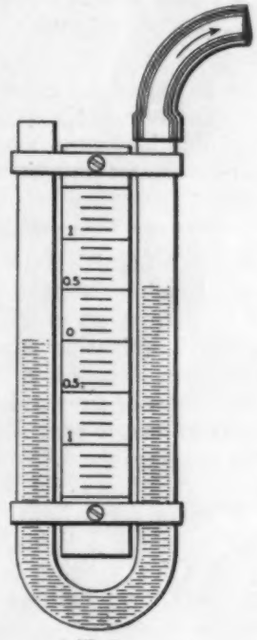

Fig. 3

is to be determined, the other arm is open to the atmosphere. A scale is placed between the arms with the zero mark midway of their height, the scale reading both ways facilitating reading the difference in level. Such a gauge is rigid and compact, but lacks sensitiveness. Gauges multiplying the indications are better adapted for investigation around boilers; such a gauge which is practical and accurate is found in the Ellison draft gauge. In this form of gauge the lower portion of the ordinary U-tube has been replaced by a tube slightly inclined to the horizontal, as shown in Fig. 4. By this arrangement any vertical motion in the left hand upright tube causes a very much

greater travel of the liquid in the inclined tube, thus permitting extremely small variation in the draft pressure to be read with facility.

The gauge is first leveled by means of the small level attached to it, both legs being open to the atmosphere. The liquid is then adjusted (by adding to or taking from it) until its meniscus rests at the zero point on the right. The left hand leg is then connected to the source of draft by means of a piece of rubber tubing. Under these circumstances, a rise of level of one inch in the left hand vertical tube causes the meniscus in the inclined tube to pass from the point 0 to 1.0. The scale is divided into tenths of an inch, and the subdivisions are hundredths of an inch.

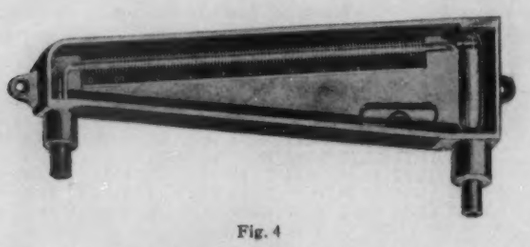

Fig. 4

The right hand leg of the instrument bears two marks. By filling the tube to the lower of these the range of the instrument is increased one-half inch; i. e,, it will record draft pressure from 0 to 1½ inches. Similarly, by filling the upper mark, the range is increased to 2 inches. When so used the observed readings in the scale are to be increased by one-half or one inch, as the case may be. The makers recommend the use of a non-drying oil for the liquid, usually a 300° test refined petroleum, but water suffices for all practical purposes.

LONDON GAS AND TELEPHONE CHARGES.

There are seven London companies furnishing gas, and the charges vary from 49 cents per 1000 cubic feet to 69 cents, the illuminating candlepower being from 14/8600 to 16/9200. There is a discount allowed by most of the companies of from 2½ to 5 per cent to large consumers, 10 to 20 per cent for power, and 10 to 25 per cent for gas engines. The charges for gas meters vary, being as follows in four companies: First company, 49 cents for 3 lights to $36 for 500 lights; second, 40 cents for 3 lights to $3.90 for 50 lights; third, 73 cents for 3 lights to $12.16 for 200 lights; fourth, 73 cents for 3 lights to $29.20 for 500 lights. The average charge per 1000 cubic feet for public lamps ranges from 49 to 59 cents.

The rates of subscription (including one telephone at the subscriber's premises) are as follows:

Ordinary message-rate service: (1) Charges for connection with any exchange in the county of London within 2 miles of the subscriber's premises, annual subscription, £5 ($19.46); message fees, 2 cents for each call to a subscriber on any exchange in the county of London, 4 cents for each call to a sbuscriber in any exchange outside the county of London. (2) Charges for connection with any exchange outside the county of London, within 2 miles of the subscriber's premises, annual subscription, £4 $19.46); message fees, 2 cents for each call to a subscriber on the same exchange, 4 cents for each call to a subscriber on any other exchange. The minimum yearly amount payable by each subscriber for message fees is $7.30.

The telephone trunk lines which connect the various telephone exchange areas throughout the Kingdom are under the control of the Postmaster-General and are worked by his officers. The trunk lines can be used by callers at postoffices which are connected with the trunk telephone system, as well as by subscribers and callers using telephone exchanges.

DISCUSSION ON STEAM ENGINEERING PRACTICE.[1]

Depreciation, Maintenance and Up-keep.

J. G. De Remer: Tonight we wish to take up the subject of depreciation, maintenance and up-keep. It is our desire to hear the opinions of the older operating engineers. From these opinions covering many of the plants which have operated and are now operating in San Francisco we should be able to arrive at a fair average charge or percentage to be set aside as a depreciation fund. We shall further get at a definite understanding of what we mean by the term depreciation, and we should also learn something about the general care which the engineers are giving their plants in order to keep down the deterioration which necessitates the depreciation fund. The distinction to be made between depreciation, and obsolescence due to the progress of science and engineering should also be considered by the operating engineer.

H. D. Saville: The calculation of depreciation is an indefinite matter. The California Street Railroad Company plant has been in operation since 1891 for about 19 hours a day. It was built for a speed of 65 r.p.m. and was later increased to 75. The engines have a 54 in. stroke. High, intermediate and low pressure cylinders are widely separated. The high and low may be run as compound or the three together as triple, or the low can do the entire work of all three. It was rebuilt after the fire and is in operation today and is just as economical as it ever was. There are the same boilers with one or two new ones added to the original installation. This is one extreme case.

The Market Street engines which pulled the Market Street cable cars are another good example. There are innumerable cases opposed to this, but the average life where they are not rendered obsolete by virtue of modern improvements is about 25 or 30 years.

The Redondo plant has increased in efficiency considerably over what it was left by the builders, yet plans for a steam turbine installation are now being carried out. A city plant of this company was recently shut down entirely. This plant was not worn out yet modern improvements along the line of turbine development has taken this plant out of continuous service.

G. Lineau: The question of depreciation has various angles. If we are putting in a power plant we want to determine what we are going to put aside for a future fund. The causes of depreciation are two: the economic and those due to wearing out. A boiler might be as good at the end of 20 years as on the day when you bought it. The best way to get this data, is for the members to give general ideas as to the present conditions of boilers, engines, etc..

In the Mills Building Stirling boilers were installed in 1892. Oil was burned for six years. Altogether 13 new tubes have been put in. The boilers are worth as much today as when they were put in, and they are clean and have not depreciated at all and there is no corrosion. There was a little pitting at one time but this was soon done away with. The boilers have not depreciated to any extent. The electric end of the plant however is sadly out of date. The Edison bi-polar generators and Corliss engines being still used. The rest of the plant is as good today as when put in.

[1]California No. 3, N. A. S. E., Aug. 24, 1910.

The insurance inspectors have not reduced the pressure any and it is running today at 125 lb. in contradistinction to 100 lb. a while ago, although there has been no material betterment in the boilers. They are cleaned once a month. Firebrick is a continual expense but this is not concerned with the boiler.

J. B. Williams: I charge 5 per cent as depreciation or reserve fund and my place has been going two years. There has been no expense for repairs or for the boiler end of it, yet I believe that a sinking fund should be provided for any cases of extreme emergency such as accidents, etc. One of these would tear a great hole in the sinking fund. I make a total of 13 per cent in all charges against the plant.

G. Lineau: I contend that the depreciation of the plant is not concerned with accidents. Some plants would not be covered with 5 per cent and an accident should not be charged to depreciation.

J. G. De Remer: Almost all these matters are covered by accident insurance. You pay a premium for this insurance and this would not come out of the fund.

H. D. Saville: Say we have a plant costing $100,000 in round figures, assuming the life to be 20 years, right off there is a depreciation charge of $5000 a year so that we could put in a new plant at the end of 20 years. This might run a year and possibly we could get but $10,000 for it, as is true in the case of automobiles. In my own case in the Merchants' Exchange Building, there are installed two Stirling boilers. In regard to the brick-work it was in bad shape after the fire and was rebuilt, but the boilers never cost five cents except for renewals of accessories and improvements. These boilers are to the mind of the insurance inspectors as good now as any they have ever seen. They are opened once a month and are given the best care. We also have a system of inspection which is well carried out. We have never lost a tube or had one leak. During the winter months the boilers are forced hard though they never leak in any way nor have any accidents. They are in just as good shape now and except for crystallization there is no cause for depreciation being taken into account. There was once a little pitting in a section of the drum but it was immediately noticed and cared for. Since 1904 this plant has been in operation all the time. The other apparatus in the building is constantly receiving care, and 5 per cent is a fair amount of depreciation to be charged against that. The steam pressure has not been changed.

W. P. Milner: Depreciation is what we lose in efficiency, and is the increase in cost necessary to keep a plant in order as it grows older. The discovery of a new system of getting power should not be considered depreciation on a given plant. It might cost $100,000 to secure it and at the time of its being finally put in it might not be modern; so it might not be as up-to-date as a new one or as economical. Take rather the example of a similar plant being put in in the place of the old. Accidents would rather come under the head of maintenance. A man pays out of his own pocket for break-downs, crank getting loose, etc.

W. T. Talbot: There is an insurance against the interruption of service now. Depreciation insures against the gradual wearing out. A plant properly handled might last forever but it would never last forever because of corrosion and the lowering of the pressure sooner or later. A new cylinder must be put in, etc. This is what we are trying to find out.

Chas. Dick: A boiler will not last forever and there is a limit of time for its running and the question is what is that time. A new boiler was put in on the Southern Pacific because the boiler was 27 years old. Would this be a fair depreciation insurance? Two boilers about fifty years old were run at 40 h.p. and these were in good shape with heavy alkali water used. About 15 tubes were put in these boilers in 15 years and if it had not been for the earthquake they would be operating today. The boilers were at one time increased to 100 h.p. After the earthquake the inspector gave 251 lb. more pressure than before. There was nothing in either which was not as good as could be. One boiler could have been sold for $600. It was iron and the plate was one-half inch thick in most places. A steel boiler will get bad much sooner where there is a bad circulation of air. Soot is the main thing with which to contend. Where boilers have a good circulation of air and are free from outside corrosion and well cared for inside I do not know where the percentage could be set.

J. S. Richards: It has generally been the custom on marine boilers to set 5 per cent as the proper depreciation figure, but I have seen some last long enough to bring it as low as 2 per cent, or lower. The Zealandia for instance ran quite a number of years, about 32 years, off and on, and still had her original boilers in her, while others have been renewed in less than half that time. In the sister ship, the Australia, they were tripled but they were not in as good condition. It is hard to study exactly the depreciation on account of the water, the help employed in keeping them, the assistants, etc. The Alameda and Mariposa were re-engined and re-boilered at the same time. One loafed at 13 knots and the other made 15 and a fraction, under the same conditions. The time allowed for cleaning and upkeep was less for the one being driven at 15 knots than for the other. In port you would have from Tuesday morning to Saturday noon to do anything necessary to these boilers so that there were leaks in the back connections caused by rapidly cooling them down while in the other you had eight days in port and no driving or overload and needed no repairs to speak of. Once we had to make a trial for the Naval Reserve and developed 4000 h.p. The steam-chart showed that from the time that the word was given to the end of the trial it did not vary 2 lb; it was almost absolutely perfect. She made 15.85 knots.

When the boilers were bad and care was improper, the tubes had to be renewed in two years in the marine boilers. River water was once pumped into the boilers and it corroded them because of the acid in it. As an average I think 5 per cent is not any too much in marine affairs.

In the Monadnock Building the boilers had been misused and had been overloaded and sent from one place to another, but since I have had them I have had to renew only 13 or 14 tubes in them, mostly the bottom row. They are Babcock & Wilcox boilers; I keep after them with tube-cleaners and the scale is now pretty well out of them. I open them up about once in two months. There is a saving all around in the use of Spring Valley water over well water.

As to charging to depreciation the renewal of the plant when it got out of date; if one thing does not do as well as another throw it out and get a new one, is what the American does, and he is here unlike his English brother. I believe that 7 per cent, at least, should be charged against the plant.

F. E. Carmody: The plan the government follows is to set aside 15 per cent for depreciation which includes repairs, putting in new tubes, brick-work, and so forth I have had some of the inspectors say that they have a hard time spending all the money, but they always overdo things a little. I think 5 per cent is not enough as we should charge against depreciation a good deal more than actual repairs to the machinery itself, as for instance repairs that are necessary to keep the plant in good working condition. Depreciation is the value that a thing loses from year to year and this might be called almost anything. If the life of the boiler is 20 years the depreciation should be sufficient to replace it entirely.

I think that the cost of repairs should not go in on depreciation. One plant that was well operated lasted years and is still running but the cost of repairs was enormous. A plant handled by a careful man should be charged with the repairs.

H. D. Saville: In a plant there is the first cost, then the operation, maintenance, repairs and insurance, and these have nothing to do with depreciation. After a while a cylinder has reached the ultimate depreciation and so with other parts which we must do away with and this only is depreciation.

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A Burning Question

Once again the forest fires are repeating their annual holocaust, and present indications threaten that this year's loss will be greater than that of any preceding, notwithstanding the most strenuous efforts to prevent them. Statisticians tell us that one-tenth of this country's half-billion acres of forested land are burned over every year at an average monetary cost of one dollar an acre and a life cost of one man per thousand acres burned.

A fatal synchronism seems to govern the appearance of these fires at places widely separated geographically. From every Western State during the past month have come reports of forest fires. The attendance at the convention of the Northwestern Electric Light and Power Association last week was limited, because power plant men were trying to protect their transmission lines and generating plants from the onward sweep of this devastating agent, the Seattle municipal plant and that at Snoqualmie Falls having a particularly narrow escape.

In the West forest fires are so nearly a habit, that most people think that it is impossible to prevent them. While this is in a measure true, the history of fire fighting in cities shows that the damage may be greatly minimized by effective organization. A rainless season, uncut underbrush and a careless camper may allow a fire to start, but it is only lack of organization that allows it to spread. The National Forestry Department, together with the several State wardens, have made a good start in the right direction, but are somewhat handicapped in point of numbers. The nucleus for an excellent organization lies among the hydroelectric and railroad employees that are constantly patrolling exposed sections. These men every year are called upon to fight forest fires and it is seldom that due credit is given to their efforts, it even being customary to decry the presence of these corporation representatives in the forests. It is a strange anamoly that the "special interests" are doing more active work in preventing fires than most of the men that are attacking them.

In California, especially, it is the railroads that plough furrows for fire breaks and burn over hazardous strips of ground. They carry the fire fighters to the scene and furnish the means for fighting the fire. All danger from sparks has been eliminated by the new oil burning locomotives. The hydroelectric companies, also, have put trained men into the forest, giving a patrol that quickly reports incipient fires over the companies' telephones. More than once the wide rights-of-way for transmission lines have proved effective fire breaks.

Thinking men realize that the solution of the problem of increasing forest productivity lies in the control of the fires to which they are subject. The nucleus for a forest fire department has been established and it is only necessary that they be given means for quickly reaching exposed spots, and given the numbers necessary to combat what is now proving to be one of the most constant sources of preventable waste.

PERSONALS.

Frank H. Short of Fresno was at San Francisco last week.

Sidney Sprout, electrical engineer, spent the past week in Southern California.

A. C. Sprout left on Wednesday for Siskiyou on electrical engineering business.

F. E. Learned, hydraulic engineer with Allis-Chalmers Company, is making a Pacific Coast tour.

A. M. Hunt, electrical engineer, returned to his San Francisco office on Wednesday after an outing.

John Coffee Hays, general manager of the Mt. Whitney Power Company of Visalia, is at San Francisco.

A. W. Ballard, of the General Electric Company's Los Angeles office, was at San Francisco last week.

John F. Keeran, master electrician at the U. S. Naval Station at Cavite, P. I., is at Berkeley on furlough.

C. L. Cory and C. E. Sloan of San Francisco have been making an engineering investigation at Santa Cruz.

G. R. Field, assistant general manager of the Great Western Power Company, has gone to Big Bend on a business trip.

M. H. Sherman, who is interested in the Los Angeles Pacific Railway Company, was a recent San Francisco visitor.

H. E. Sanderson, Pacific Coast manager for the Bryant Electric Company, left for a trip throughout the East this week.

J. H. Buxbaum, of the firm of Buxbaum & Cooley, electric engineers, Seattle, is at San Francisco and vicinity for a two weeks' vacation trip.

H. W. Crozier, electrical engineer of Sanderson & Porter's San Francisco office, has been spending a vacation in Southern California.

H. C. Goldrick, Pacific Coast manager of the Kellogg Switchboard and Supply Company, has returned to his San Francisco office from Portland.

Delos A. Chappell, who has charge of the engineering work on the Hydroelectric Company's new California development, is at San Francisco.

N. J. Hullin has succeeded G. W. Merrill, resigned, as general superintendent of the Sacramento Electric, Gas & Railway Company of Sacramento, Cal.

J. H. Wise, hydraulic engineer with F. G. Baum & Co., has returned to San Francisco from Alaska after making some important hydro-electric investigations.

Thomas Mirk, of Hunt, Mirk & Co., Pacific Coast agents for the Westinghouse Machine Company, returned to San Francisco on Monday from a trip to San Diego.

H. A. Lardner, manager of J. White & Co.'s San Francisco branch office, is once more at his desk after convalescing from a severe attack of typhoid fever.

H. H. Noble, president of the Northern California Power Company, returned to San Francisco on Wednesday after an inspection trip to the new Coleman hydroelectric development on Battle creek.

H. H. Sinclair, general manager of the Great Western Power Company, has returned from an inspection of the hydroelectric plant at Big Bend. Work is progressing very favorably on the dam.

F. W. Eaton, secretary. F. W. Phelps, auditor, and B. C. Carroll, special agent, formed a party of Pacific Telephone and Telegraph officials who left during the past week on an automobile trip to Lake Tahoe.

George C. Holberton, general manager of the San Francisco Gas and Electric Company, left September 2d for an extensive Eastern trip. He will inspect the lighting and power plants of New York, Chicago and the principal cities of the Atlantic Coast, with a view to gathering information as to the latest improved methods of operation, etc.

P. O. Crawford, the electrical engineer who has charge of installing the Northern California Power Company's new Coleman plant, returned to Shasta County last Sunday, after spending a day at San Francisco. Good headway has been made upon the hydraulic work and the first shipment of turbine water wheels is now en route from the Allis-Chalmers Company's works.

TRADE NOTES.

Charles C. Moore & Co. is installing for the East Side power plant of the Portland Railway, Light & Power Company eight 450 h.p. Babcock & Wilcox boilers, ten Copes feed water regulators, a 12x129 ft. Weber chimney, a Hamilton-Corliss engine, direct connected, and a 2000 kw. G. E. generator.

The Pelton Water Wheel Company reports that a contract has been closed with the Homestake Mining Company, of Lead, S. D., for three Pelton impulse units, of 3000 h.p. each, operating under a high head. Each wheel will be direct connected to a Westinghouse generator. Pelton oil-pressure governors and oil pumping system are provided for. The plant will supply current to a smelter.

The General Electric Company reports that the Phelps-Dodge Company, of New York, has purchased for the Copper Queen Mining and Smelting Company of Globe, Ariz., two A.T.B.4, 750-kw., 1800-r.p.m., 2300-v., horizontal, condensing, Curtis turbines, arranged for operation on the mixed pressure system. These steam turbines are in addition to two similar machines which were installed recently for the same company.

On September 1st, the Central Division of the Pacific Telephone and Telegraph Company was divided into five districts, with a district commercial superintendent in charge of each, reporting direct to John Kearns, the division commercial superintendent at San Francisco. The district commercial superintendents, with their respective headquarters, are now as follows: Chico District, L. M. Brown, Chico; Sacramento District, J. P. Noble, Sacramento; Fresno District, John T. Gross, Fresno; San Francisco District, F. L. McNally, San Francisco; Oakland District, T. F. Delury, Oakland.

NEW CATALOGUES.

Bulletin No. 4764, published by the General Electric Company, illustrates and describes a line of Mazda compensator and low volt lamps.

Archbold-Brady Co., engineers and contractors, of Syracuse, N. Y., have reprinted an article from the Electrical World of May 19, 1910, on "Supports for Transmission Lines," showing some mechanical aspects of flexible tower construction.

Pacific Electric Heating Company have issued an interesting folder describing their popular publicity campaign by means of their "Bill Raiser" series. This is of direct interest to central stations as it should greatly promote the use of current consuming devices.

In a 96-page book entitled "High Efficiency of Centrifugal Pumps" the De Laval Steam Turbine Co., of Trenton, N. J., have brought together some 75 charts, diagrams, photographs and a vast amount of engineering information relating to such subjects as ways and means for testing centrifugal pumps; charts of the results of such tests; the interpretation of these charts for the purposes of the engineers, etc.

PACIFIC COAST ELECTRICAL EXPOSITION.

At a boosting meeting on September 6th the exhibitors perfected final arrangements for the Pacific Coast Electrical Exposition to be held at the new Coliseum in San Francisco. September 17-24. The building will be ready to receive exhibits on and after Monday, September 12th, and it is planned to have everything completed in time for the opening night.

The building has the largest floor space of any public structure west of Chicago and the largest unobstructed area of any building in the world, covering 61,875 sq. ft., every inch of which will be taken in the electrical show which marks its opening.

The lighting arrangements will be spectacular and on a scale never before witnessed in the West. Besides the wealth of electric lights consequent upon the various electric lighting displays, the Coliseum will have an independent illuminating system as beautiful as a fairy scene. Great searchlights, colored globes, artistic designs, waving tinsel decorations and powerful arc lights will combine to produce a riot of light and color calculated to turn the seven nights of the exposition into the most dazzling mid-day brilliance.

The object of the big electrical show is purely educational. Similar expositions have been held in New York, Chicago, Philadelphia and St. Louis. This is the first one over arranged for the Coast or any city west of St. Louis, and all the big national exhibitors present at the others have applied for space in this. It is intended for the more general diffusion of electrical information, by demonstrating the rapid strides made in the use of electricity. It contemplates the display of every device for electrical light, power, transit and transmission. Besides the large mechanical uses of the current, it is aimed to clearly illustrate its advantages in the small household articles being invented almost daily. The electrical cooking machines, flat irons, sewing machines, jig saws, curling irons, toasters, heaters, water heaters, milking machines and hundreds of other useful articles known to many by name only will be intimately introduced to the general public by reason of the exposition.

As illustrating the interest taken by the exhibitors, it is stated that the Southern Pacific Railway exhibit alone will cost upward of ten thousand dollars to install. Many other displays will be equally costly. The National Electric Lamp Association, with branches all over the United States, are also expending $10,000 on their exhibit. They will show electric lamps in the making, constituting an exhibit of great educational value to electricians, to say nothing of its interest to the general public. The Western Electric Equipment Company of New York will provide a display of their wonderful instruments covering almost every field of electrical invention.

Interesting and amusing features will be plentiful. Visitors will be allowed to converse with each other at opposite ends of the Coliseum by means of the wireless telephone. The dictograph, by which messages may be sent by telegraph in the actual handwriting of the sender, will be seen. Other similar mysteries of electricity will be demonstrated and explained. There will be a unique chamber of horrors showing remarkable freaks of electricity. There will be singing and talking lamps and thousands of subjects of interest in the displays.

Every local electrical firm will take part, besides the local electrical contractors, in a body. These latter are devising the midway and other schemes to interest and amuse. The gas and electric companies, the street fire alarm and local police systems, and telephone companies are all contributing displays.

The Bay Cities Home Telephone Company expects to install and operate an exhibit displaying in actual operation the representative types of its telephone equipment. The exhibit will include working automatic switches and the various types of private exchange telephone switchboards now widely used by the company's patrons. Facilities for public telephone service will be provided so that visitors and exhibitors may use the service if they wish. Service is also to be furnished to the exhibitors by means of telephones in the various booths. The telephone company has considered the problem at length in an effort to determine what rates should be named for unlimited automatic telephone service during the period of the exposition and found that the exhibitors are uniformly present patrons of the Bay Cities Home Telephone Company.

As the cost of installing automatic telephone service for each exhibitor will be great enough to prevent a substantial profit at any nominal rate, the company has decided to install an automatic telephone in each exhibit and to furnish the service to exhibitors during the time of installing, showing and removing their exhibits and to make no charge for that service.

National Electric Lamp Association.

The member companies of the National Electric Lamp Association, through their engineering department, are planning an extensive exhibit of the latest developments in incandescent lamps, and will show several interesting devices used in the present day methods of their manufacture and testing.

Among the lamps which will be shown will be the complete line of 110 and 220 volt "Mazda" regular, 110 and 220 volt tantalum, tantalum street car lamps, "Mazda" street series, "Mazda" sign lamps and miniatures. Part of the lamps will be shown burning on racks, and the remainder will be exhibited in glass show cases.

Several features are being prepared which will undoubtedly excite considerable interest. There will be shown a device consisting of a box of wood and cloth in which three mirrors and a lamp are to be mounted in such a manner that by revolving the box about a horizontal axis, the intensity of light at any angle in a vertical plane through the lamps may be observed. The apparatus will show how the light distribution about a lamp may be readily obtained, and will illustrate the significance of such distribution.

Another feature will show the balance position of a Bunsen photometer screen for a 100-watt "Mazda" lamp and a 100-watt carbon lamp. Two indicating wattmeters will show the equal consumption of power, while the position of the photometer screen will show the increased light intensity of the "Mazda" lamp over that of the carbon.

A set of automobile headlights, sidelights, etc., will be shown equipped with "Mazda" lamps. Upon an oak rack will be mounted ten 16 c.p. carbon and ten 16 c.p. tantalum street car lamps. An integrating wattmeter will show the kw. hours consumed by each set of lamps during the time of the show.

The booth decorations will be elaborate and in keeping with the general decorative scheme of the Coliseum. A large portion of the booth will be made attractive by means of a pergola, which will be built inside the booth. This portion is intended for the reception of visitors.

Mr. A. J. Hitzker of the engineering department at Cleveland and Mr. L. S. Twomey, the Pacific Coast illuminating engineer for the Association, are already on the scene and are

A pole-top switch for use in the power lines, and adopted by about 80 per cent of the Pacific Coast power systems, for cutting off branch lines and sub-stations and grouping or segregating the main lines, will also be set up so that it can be operated and inspected as though it were in place on the power line.

This company will also exhibit some disconnecting switches for lower voltages of the type that they are furnishing to many large power generating companies, to show the finished excellence of their output.

The Wooll motor protecting switch will also be a part of this exhibit, and the first exhibition of this ingenious and low-priced switch will doubtless be a pleasing discovery for using every effort to make the coming exposition the best of its kind ever held.

Pacific Electric and Manufacturing Company.

The exhibit of the Pacific Electric and Manufacturing Company will interest all those who are familiar with the great development of power transmission in recent years, as it will consist of several switches similar to those used in the mountain power houses and on the miles of high-voltage lines.

An oil switch will be shown, operated with an electric control and made for service under a pressure of 80,000 volts, which will forcefully illustrate the immensity of the machinery that is required to successfully handle the output of the hydro-electric systems.

the many users of small motors who have long been in need of just such protection.

Fort Wayne Electric Works.

The main feature of the exhibit of the Fort Wayne Electric Works is to be their new electric rock drill, which will be publicly demonstrated for the first time at the Pacific Coast Electrical Exposition. A huge block of sandstone weighing seven tons will be the "piece de resistance" in proving the effectiveness of this much-needed addition to mining machinery that may be electrically operated.

H. W. Johns-Manville Company.

The H. W. Johns-Manville Company will feature their latest types of the J-M linolite system of electric lighting, "Noark" service and subway boxes. "Noark" enclosed fuse material, J-M dry batteries, J-M fiber conduit and fittings.

Quite a complete line of J-M asbestos roofing, insulating materials and J-M packings will form an additional feature of the exhibit.

One of the most novel features of the exhibition is to be the display of the various makes of electric vehicles. This convenient and economical mode of urban traction is fast being introduced in Pacific Coast cities. During the show a business meeting of the Pacific Coast Electric Vehicle Association will be held, at which a number of important matters will be discussed.

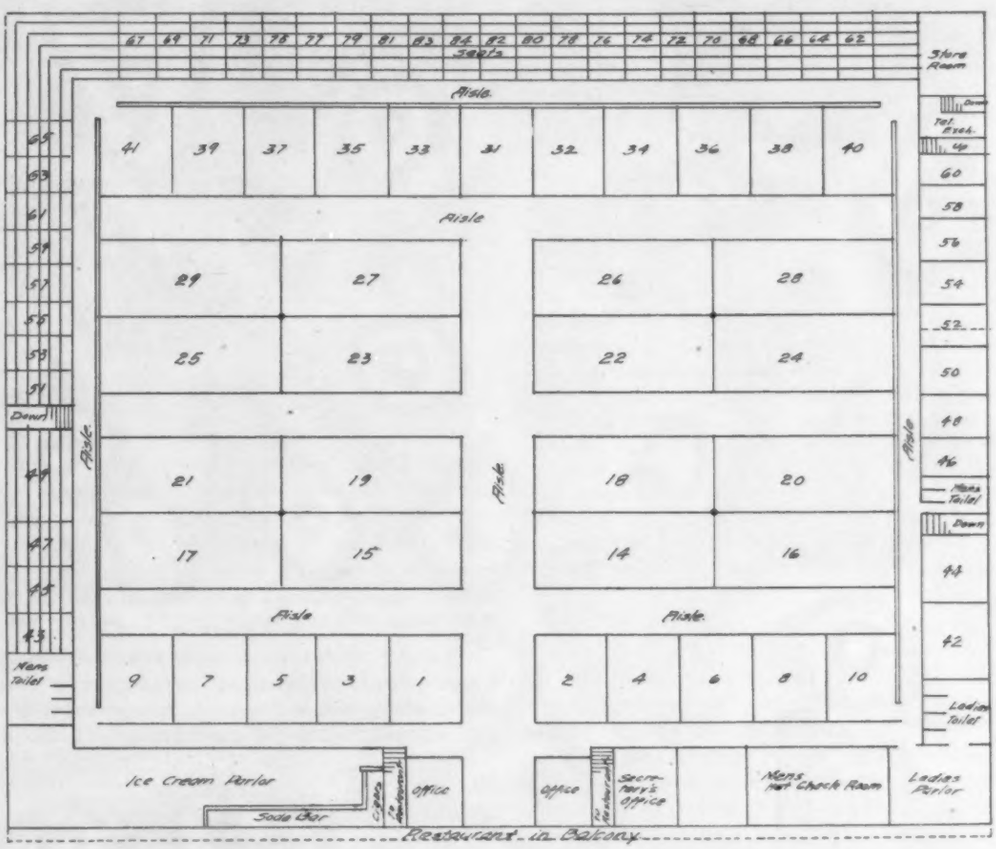


Diagram of Floor Space Arrangements at Pacific Coast Electrical Exposition

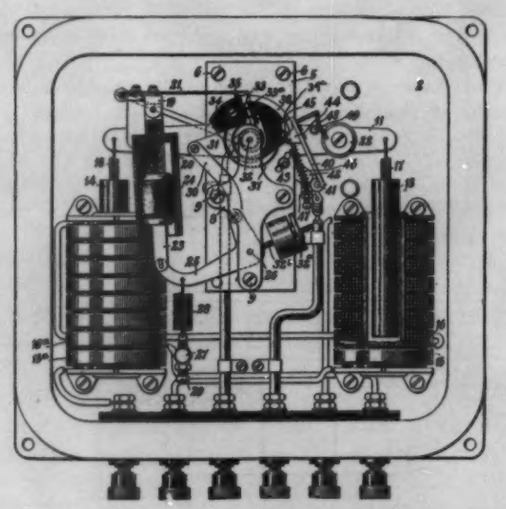
Descriptions of other interesting exhibits will appear in the next issue of the Journal, contributions being invited from all exhibitors.

SPECIAL RAILROAD RATES FOR PACIFIC COAST ELECTRICAL EXPOSITION.

For the occasion the Southern Pacific Company has established reduced rates from all points in California to San Francisco on the receipt-certificate, fare and one-third basis for the round trip. The return portions of tickets to be validated by holder at the company's exhibit at the exposition. Tickets will be on sale at all offices at the reduced rate September 12th to 24th, and bear a return limit from the 17th to 27th of September.

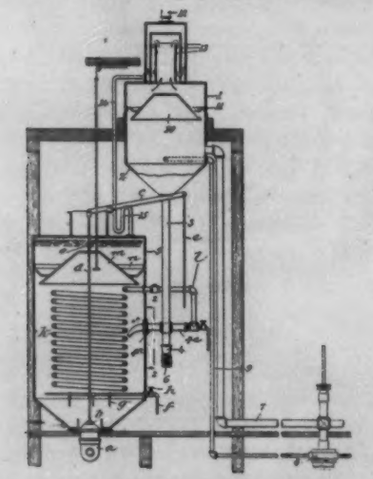
PATENTS

968,579. Automatic Synchronizer. Paul MacGahan, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. The combination with an alternating current circuit, an alternating current generator, and means for



connecting the generator to said circuit, of means for insuring operation of said connecting means when the currents in the generator agree in phase with those in the circuit, said means comprising two solenoids each having two windings, those of one solenoid being arranged to act in opposition and those of the other to act in conjunction when the currents in the windings agree in phase.

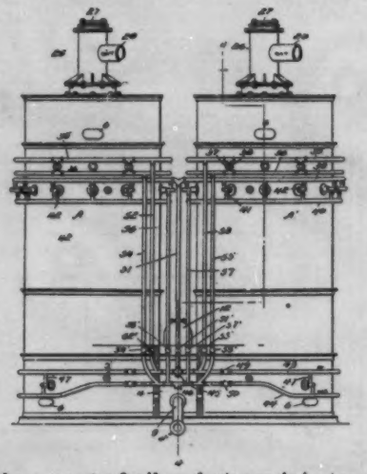
968,534. Gas-Separator for Oil Wells. Linus W. Brown, Bakersfield, Cal. In combination with an oil well, a drum, means for delivering crude oil from the well to the drum, baffle plates arranged within the drum above the point of delivery of the crude oil, a device in communication with the upper portion of the drum, having a circuitous passage for the



outlet of the crude oil gas, a sand and oil separator, and means for discharging the crude oil from the lower portion of the drum into the separator as fast as it is received from the well.

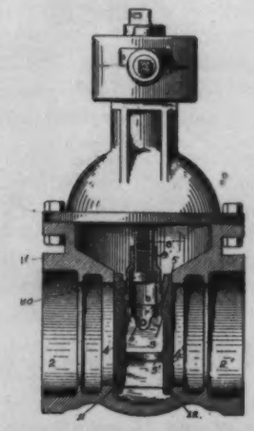
968,640. Refining Petroleum. John C. Black, Richmond, Cal., assignor to Standard Oil Company, Richmond, Cal. The improvement in refining California or analogous petroleum, consisting in forming outside the oil to be treated a mixture of subdivided sulfuric anhydrid and diluent gas, subjecting such petroleum at sludge producing temperature and in the form of burning oil (kerosene) distillate containing smoky or sulfurous hydro-carbons which resist removal by sulfuric acid at 66° B. to such mixture, continuing the treatment with such mixture until an amelioration of the oil is effected in respect to its content of said smoky or sulfurous hydrocarbons, and separating the resulting sludge and the so refined oil from each other, substantially as described.

969,085. Gas-Generating Apparatus. Adelard D. Brasson and Anton A. Yankee, San Francisco, Cal. A gas generating apparatus comprising a pair of generators in communication at their lower ends, each generator having a stack with an air blast pipe connected therewith and provided with a top combined mixing and combustion chamber and a bottom com-



bustion chamber, a set of oil and steam injector nozzles communicating with the lower combustion chamber, a set of oil and steam injector nozzles communicating with the upper combined mixing and combustion chamber, supply pipes connected with said nozzles, distributing pipes connecting the supply pipes of both generators with each other and provided with controlling valves, and a secondary air blast means communicating with the connection between the generators.

968,944. Valve Mechanism for Gate-Valves. George J. Henry Jr., San Francisco, Cal., assignor of one-half to The Pelton Water Wheel Company. In a gate valve for high pressure water systems, the combination with the casing thereof



provided with parallel valve seats, an integral valve composed of two parallel disks separated by a connecting body slidably mounted within the casing and acting against said seats under water pressure, a guide rail within the casing for supporting and on which said valve slides, and means for actuating said valve within the casing.

INDUSTRIAL

SWITCHBOARD EXHIBIT OF AGUTTER-GRISWOLD CO.

The Agutter-Griswold Co. of Seattle recently assembled as a "Made in Washington" exhibit in the window of the Seattle Electric Company some of the work that this company is furnishing to eight or ten large jobs. Included in the exhibit is the large testing switchboard for the Seattle Electric Company's new building, metering panels and cabinets for the new Cobb building, and the equipment for the new Providence Hospital.

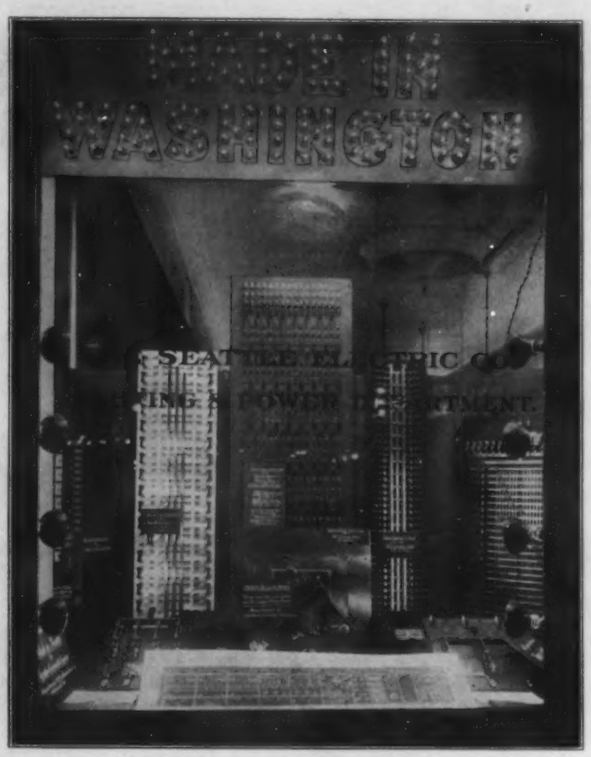


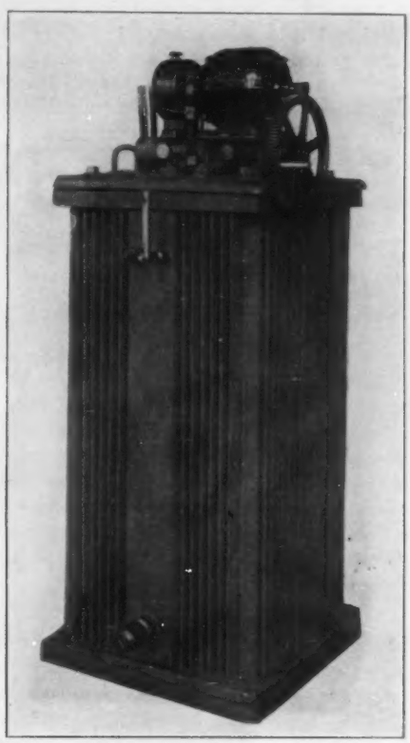
Exhibit Agutter-Griswold Co.

The exhibit as shown in the accompanying illustration includes knife switches, panel switches, metering panels, switchboards, steel cabinets and accessories, all manufactured by this company.

WESTINGHOUSE INDUCTION TYPE POTENTIAL REGULATORS.

The motor operated single-phase induction regulator shown by the accompanying illustration embodies the several improvements recently made in this line by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Although the general design of these regulators remains unchanged, modifications have been made that insure not only a higher degree of satisfactory operation, but longer life.

The skeleton frame construction of the new type single-phase potential regulator permits the use of a "cast-in" corrugated sheet metal tank which affords a larger and more efficient radiating surface than the cast iron tanks used with the earlier regulators, thereby insuring a low operating temperature. This type of tank is also less liable to give trouble from oil leakage, which sometimes occurs with the cast iron tanks on account of unavoidable defects in the castings. In the latter, the leaks usually developed after the punchings and windings had been placed in position, thus causing considerable loss of labor in the work of rectification, while it is noteworthy that, in the case of the "cast-in" tank, a defective tank entails no other loss than the tank itself. In the earlier designs the cast iron tank was bored out to receive the stator punchings. As this tank was open only at the top, difficulty was sometimes experienced in obtaining inner cylindrical surface which would be in perfect alignment with the rotor bearings located in the cover and bottom of the tank.



Induction Type Potential Regulator

Up to and including the 95-kw. size, the polyphase regulators have "cast-in" corrugated sheet metal tanks. They are similar to and possess all the advantages of the "cast-in" type of tank. They possess great strength mechanically, have large radiating surfaces and dirt and dust-proof qualities. An oil gauge at the top and a valve as oil drain at the bottom are provided. The regulator is shipped assembled in its case. Above 95-kw. the regulators are usually oil insulated and water cooled. Boiler iron cases with cast iron bases and covers are usually used.

The single-phase regulator has an inherent tendency to vibrate, but this has been overcome in the Westinghouse regulator by a careful design of the bearings and shaft. The moving element is carefully centered so that a uniform air gap is secured. Furthermore, the tendency to vibrate is reduced due to the low point on the saturation curve at which the magnetic circuit of the regulator is worked. An agreeable result of the elimination of the vibration is the noiseless operation of the regulator.

"The Electric Lighting of Automobiles" is well treated in Bulletin 12 from the Engineering Department of the National Electric Lamp Association. It contains valuable and practical data in automobile electric lights and lighting.

HIGH TENSION WEATHERPROOF FUSE AND DISCONNECTING SWITCH.

With the increasing capacity of central station distribution systems it is rapidly becoming recognized as good engineering practice to install disconnecting switches at such points as to isolate the various feeders or important transformer installations. To meet these new conditions a number of weatherproof switches have been developed, but the majority simply furnish a means of disconnecting service without affording protection against overloads or short circuits. Under these conditions it is therefore necessary to also install fuses or circuit breakers at the transformers, or other points of the circuit to be protected.

A solution of the conditions imposed by modern practice is offered in the combined weatherproof fuse and disconnecting switch shown in the accompanying illustration which has been developed into a commercial device after having been thoroughly tested in actual operating service. The line conductors are soldered directly to heavy detachable connectors arranged to be fastened to terminal plates which in turn support a pair of special contact jaws for reception of the fuse chamber.

High Tension Weatherproof Fuse and Disconnecting Switch

The supporting element is made of iron so treated as to resist weather conditions and of sufficient mechanical strength to minimize danger of breakage during installation. At each end of the supporting frame is located a slot to permit insertion of lag screws to attach the device to cross arms, poles or walls.

On two projecting pins are mounted a pair of petticoat high tension insulators having great mechanical strength and high insulating qualities. The design and dimensions of the insulators are such that the standard maximum surface or creepage distance is secured and the factor of safety is then doubled by employing designs for double the actual line voltage or test conditions. For example, a 13,200 volt device is equipped with insulators tested for 25,000 volt line pressure and 70,000 volt break down test.

Fastened at the top of each insulator is a specially designed locking contact device of such contour that the weatherproof fuse chamber can be inserted in the usual manner. The construction is such that a blown fuse can be easily be replaced by the use of insulating tongs, or when desired the entire element can be swung open as a disconnecting switch, thus effectually killing an entire section of line.

The fuse is of the enclosed type and specially constructed to resist weather conditions. The construction is such that the blowing time is practically constant under varying temperature so that transformers or other apparatus can be thoroughly protected by proper size fuses.

Especial care has been taken in designing this fuse to insure rapid condensation of the expanding gases generated by volatization of the metal during the fuse period and to break up their continuity. This rapid cooling and absorbing, or dissipation of these gases is of the highest importance and the result is a fuse which will not only meet the difficult conditions imposed by outdoor service, but also quickly suppresses and prevents holding over of the heavy arc incident to short circuits and overloads.

Rapid lowering of the gas temperature to a point where their conducting power ceases is also of great importance in preventing danger of explosions which would tend to strain or even destroy the fuse casings. In the design illustrated this feature is further safeguarded by employing a casing having high mechanical strength and of such dimensions that internal pressures generated by fusing will not cause damage.

A complete line has been developed for all commercial voltages, the ampere limits at present being as follows:

2200 volts—200 amperes.	13,200 volts—20 amperes.
3300 volts—150 amperes.	22,000 volts— 6 amperes.
6600 volts— 30 amperes.	

The spacing distance between contacts conforms to recognized commercial practice, thus eliminating the danger of leakage under operating conditions, or danger to the line man during installation or inspection. This new device is manufactured by the Delta-Star Electric Company of Chicago, Illinois, and should prove of much service to central station managers operating high tension distribution lines.

NEW CATALOGUES.

The Sprague General Electric type M control system is described in a new bulletin, No. 4761, just issued by the General Electric Company.

Bulletin No. 4754, recently issued by the General Electric Company, describes in considerable detail that company's continuous current and alternating current motors for use in steel mills, and similar places, in connection with cranes, hoists and other apparatus.

In bulletin No. 4746, recently published by the General Electric Company, is described a portable sub-station for the supply of intermittent power for electric roads, and to provide for a temporary supply of power in case of accidents at sub-stations equipped with only one rotary converter unit.

"The Advertising of the Westinghouse Vehicle Motor," as issued by the Westinghouse Electric and Manufacturing Company, contains a number of ads to be used in a popular publicity campaign which will greatly redound to the benefit of central station men in the way of increased demand for current.

The Thomson polyphase watthour meters, which are made for the specific purpose of measuring energy in any two-phase, three-phase or monocyclic circuit, are described in Bulletin No. 4762 of the General Electric Company. These meters may be applied to a circuit carrying a mixed load of lamps, motors or other translating devices, and will record accurately, irrespective of unbalanced load conditions.

The first of a series of booklets entitled "Modern Merchandising Establishments," has been issued by the Nernst Lamp Company in conjunction with companies dealing in high class store furnishings, with a view of giving merchants information of value in store arrangements. The first booklet deals with Marshal Field & Co.'s Chicago store, and the next will be on the new Higbee store in Cleveland, and will give a full description of every detail of spacing and display.

Bulletin No. 4758, published by the General Electric Company, is devoted to Mazda sign lamps and contains a statement of the characteristics of these lamps, wiring diagrams showing the method of changing regular multiple sign wiring to series for Mazda sign lamps, and other wiring methods. It contains tables giving the size of wire for feeders, with different arrangements of lamps. It also contains what will be found interesting data on comparative cost of electric signs, illuminated by carbon and by Mazda lamps.

NEWS NOTES

INCORPORATIONS.

BAKERSFIELD, CAL.—The Wagg Water Company has been incorporated by Jas. Ogden and C. B. Warner of this city, J. I. Wagg, F. V. Gordon and F. D. McGuire of Los Angeles, with a capital stock of $100,000.

LOS ANGELES, CAL.—The Midway Light & Power Company has been incorporated by H. L. Dearing and Herbert Williams of Los Angeles, E. F. Hughes of Sierra Madre, H. J. Gondge of Alhambra and C. L. Chandler of South Pasadena, with a capital stock of $250,000. Plants will be located at Moran and Maricopa, Cal., and the principal place of business will be in Los Angeles.

FINANCIAL.

TURLOCK, CAL.—The bonds carried at the election held and an indebtedness of $25,000 will be involved, $13,000 for a waterworks system and $10,000 for a sewer system.

WALLA WALLA, WASH.—Projections of Pacific Light & Power Company are being inspected by C. Z. Mitchell. $30,000,000 has been borrowed by the company for developments.

MONROVIA, CAL.—An election will soon be called here to submit to voters a proposition of voting bonds in the sum of $50,000 for the construction of a water system and $120,000 for constructing a sewer system.

OCEANSIDE, CAL.—On September 14th the city will hold a bond election to vote on the proposition of issuing $20,000 in 5 per cent bonds for improvements on the municipal water system, which includes the replacing of wooden mains with iron pipe.

HUNTINGTON PARK, CAL.—The citizens of this place have voted on the question of a municipal water plant. An election was called in order to ascertain whether or not the majority were in favor of a $60,000 bond issue with which to build and equip a municipal plant. The issue was defeated.

SANTA BARBARA, CAL.—By a vote of 6 to 1 with 1430 votes cast, the city has indorsed a bond issue of $200,000 to pay the cost of driving the last mile of the four-mile tunnel through the Santa Ynez Mountains. When completed the upper Santa Ynez basin becomes available as a water supply. The total cost of the work, including dams, is expected to reach $1,000,000.

LOS ANGELES, CAL.—The Council has authorized the issuance of $6,500,000 harbor improvement and aqueduct power plant bonds recently voted by people of this city. The Council authorized the issuance of $3,000,000 of harbor bonds which when available, will be used in pushing to completion the proposed construction of the harbor highway, and establishment of municipal wharves, docks and warehouses. A second ordinance was adopted authorizing the issuance of $3,500,000 for aqueduct power bonds. The money will be available about October 1st.

TRANSPORTATION.

SALT LAKE CITY, UTAH.—The County Commissioners have granted a 50-year franchise to A. Evans et al., to construct an electric suburban railroad through Utah county.

LOS ANGELES, CAL.—A cross town line has been recommended by the board of public utilities. The route proposed is west on Vernon, from Santa Fe to Vermont avenue, north to the S. P. crossing; north to Jefferson, east on Jefferson to Hoover, north to Park View, north to West Seventh street, west to Rampart and north to West Temple.

TACOMA, WASH.—The council has passed an ordinance permitting the Northern Pacific Railway Company to erect and maintain poles and string wires for the transmission of electric power in Railroad avenue.

SOUTH BEND, ORE.—J. D. Carey has asked the cities of South Bend and Raymond to grant him a franchise to build and operate an electric road between the two cities, and if granted, agrees to begin work immediately.

LOS ANGELES, CAL.—H. E. Huntington will construct an electric line to connect Redondo Beach with San Pedro. Surveyors are mapping out a prospective right of way for an electric line along the cliffs overshadowing Point Vicente and Point Fermin.

PASADENA, CAL.—The officers of the Pasadena Rapid Transit Company have sent notices to the stockholders calling a meeting for October for the purpose of creating a bonded indebtedness of $3,000,000 which is to be used to secure the balance of the right of way between Pasadena and Los Angeles, and to purchase power house and depot sites necessary to complete the proposed electric line. President Horace Dobbins states that construction of line will begin some time during the winter.

VANCOUVER, B. C.—The 65-mile interurban line of the British Columbia Electric Railway Company between Vancouver and New Westminster, is now 11 miles out from Vancouver. Other work under way includes 8 miles from Vancouver to Port Gray, two miles in South Vancouver, two miles between North Vancouver and Capilano, and a completed stretch of 2½ miles between North Vancouver and Lynn Valley. A 6000 kw. auxiliary steam turbine plant has been recently completed and a 2000 kw. rotary converter added to the Vancouver substation.

TRANSMISSION.

PRESCOTT, ARIZ.—The Arizona Power Company is to expend $100,000 in building a new 40-mile wire from Verde valley to Prescott by the way of Jerome.

SPRINGFIELD, ORE.—District Manager Spencer of the H. M. Byllesby Company announces that the company's power plant here, will have a redoubled capacity, work to begin this year.

UPLANDS, CAL.—The Pacific Light & Power Company will construct a power line from Sixteenth street wells line, north and east of the city, directly north to Wineville, a distance of 11 miles. A power station (substation) will be erected in the vicinity of Cucamonga.

BREMERTON, WASH.—The Council has granted to the Bainbridge Development Company authority to construct and maintain poles and wires over the roads and highways of Bainbridge Island, Kitspa county, State of Washington, for the purpose of the transmitting, distribution and sale of electric current for electric power, heat and light.

ILLUMINATION.

PRINCE RUPERT, B. C.—City Engineer Davis is preparing plans for temporary and permanent lighting systems.

LEWISTON, IDAHO.—E. H. Libby of the Lewiston-Clarkson Improvement Company asking the city for a lighting and heating franchise.

HOQUIAM, WASH.—Reports have been received here that the gas syndicate which has brought gas to Olympia and Gate will extend its system on to Aberdeen and this place.

REDMOND, ORE.—An application has been received from the Odin Falls Power Company asking for a franchise to furnish this city with power and light.

REDMOND, ORE.—The Council has passed an ordinance granting a 20-year franchise to the Crook County Water, Power & Light Company to furnish the city of Redmond with electric light and power.

SAN FRANCISCO, CAL.—The San Francisco Gas and Electric Company has plans for a reinforced concrete battery house which is to be erected on Minna street, east of Eighth street. The work will cost about $10,000.

LOS ANGELES, CAL.—An ordinance has been passed consenting to the abandoning of a portion of a street franchise granted to Robert March and John Houze, commencing at Vermont avenue and Thirty-ninth street.

LOS ANGELES, CAL.—The Board of Public Utilities has approved the petition of the Los Angeles Railway Company asking for permission to abandon a franchise granted several years ago for a line along Park View avenue from Ninth to Eleventh streets.

POMONA, CAL.—The City Trustees have instructed the Southern California Edison Company to install incandescent street lights on E. Third, Fourth and Fifth, Kingsley, Palm, Laurel and Williams, W Fourth, W. Holt, North Garey and Illinois streets.

MADRAS, ORE.—There is a prospect of Madras getting a public water system and electric lighting plant. The Newport Engineering Company of Portland is now taking an interest in the matter and its representatives will look after securing a franchise from the city of Madras to install the plant and maintain service.

SAPULPA, OKLAHOMA.—The Sapulpa Electric Company has been purchased by H. M. Byllesby & Company of Chicago, who will hereafter operate and manage the property. The electric lighting and power system at Sapulpa is new, but in the past has been able to serve only about one-half of the immediate demands. Byllesby & Company will at once install a 500 kw. generating unit which will more than double the capacity at the station.

CREEDE, COLO.—MacArthur Brothers Company has been awarded a contract by the Rio Grande Reservoir & Ditch Company for the construction of a storage reservoir at Santa Maria Lake, twenty miles from Creede, Colorado. The work will consist of a large earth dam, about 90 feet high, a 40-inch continuous wood stave pipe, 8000 feet long;, an outlet tunnel, about 600 feet long; an outlet canal 3000 feet long; spillway, diversion dam, and a large amount of ditch work. Amount of contract, $200,000. Work will be started immediately and will be completed by next summer. MacArthur Brothers Company have just completed a large dam for the Eastern Colorado Power Company, near Boulder, Colo., and will be able to shift much of their plant onto this work.

WATERWORKS.

OGDEN CITY, UTAH.—Upon the recommendation of the waterworks committee it has been ordered that a 6-inch water main be placed from Washington avenue to the State Industrial School.

HILLSBOROUGH, CAL.—A contract has been let to M. A. Elftman of San Mateo for the concrete work in a new 500,000-gallon reservoir which is to be constructed in the hills back of Uplands.

SEATTLE, WASH.—The Council has passed a resolution providing for the improvement of a portion of First avenue West and Queen Anne avenue; First avenue North, Florentia street by the construction of watermains.

SOUTH BEND, WASH.—P. E. Hall of Everett has asked the city of South Bend to grant him a franchise for 45 years to furnish a supply of water for manufacturing and fire protection purposes.

LOS ANGELES, CAL.—Engineer F. E. Trask, Los Angeles, is making plans for an extension of the municipal water system of Ontario. to cost $125,000. A new reservoir will be built and pipe lines laid.

BENTON, WASH.—At the meeting of the Benton City Council a discussion relative to the securing of water for domestic purposes was brought up and was finally disposed of when a committee was appointed to confer with the Prosser Power Company and ascertain on what terms water could be produced and furnished from wells.

REDONDO BEACH, CAL.—A syndicate composed of Los Angeles capitalists is negotiating with Hermosa Beach Land & Water Company for the purchase of the water system which supplies Hermosa Beach, Shakespeare and Manhattan Beach with water. In case the deal is consummated, the system will be enlarged and a new pumping plant installed.

ASHLAND, ORE.—If the City Council adopts the recommendation of W. J. Robertson, consulting engineer, the city will install a water system adequate for a city of 50,000 This system includes a high pressure reservoir of 4,000,000 capacity, and a low pressure reservoir holding 1,000,000 gallons, together with a complete re-arrangement of the pipe lines, and can be established by an expenditure of about $100,000.

BURLINGTON, WASH.—The rapid increase of population in the town of Burlington has brought about a condition that makes a water supply for the town an immediate necessity. V. M. Harpst of the Harpst Lumber Company, has long taken a deep interest in this water question. The Commercial Club took the matter up and appointed I. J. Howe, O. Peterson and C. I. Henderson as a committee to confer with Mr. Harpst.

TELEPHONES.

ELMA, WASH.—Telephone connections east of here were destroyed by forest fires.

VICTORIA, B. C.—The B. C. Telephone Company will erect a building for central station in this city.

BUTTE, MONT.—The Montana Independent Telephone Company will install an automatic long-distance system.

RENTON CITY, WASH.—Arrangements are being made for a large number of telephone extensions in this place.

VANCOUVER, B. C.—The B. C. Telephone Company will remove poles from business section and run underground conduits.

VANCOUVER, B. C.—C. P. R. cable between here and Victoria is nearing completion. It will be ready about October 1st.

VANCOUVER, WASH.—The Spokane, Portland and Seattle Railway is equipping lines to handle service by telephones.

MISSOULA, MONT.—Rocky Mountain Bell Telephone Company is making rapid progress on repairing line to Wallace, Idaho.

GRANGEVILLE, IDAHO—Telephone lines between this place, Stites and Elk City are under re-construction. Percy Ellis of Stites is in charge.

TACOMA, WASH.—The commission has ordered all telephone companies to have all overhead telephone wires underground before September, 1911.

PUYALLUP, WASH.—John King & Son of McMinnville have purchased controlling interest in Puyallup Valley Home Telephone Company. They contemplate important extensions in the near future.